Remarks:

Regarding the rejection of claims 1, 3-7, 13 and 14 under 35 USC 103(a) in view of US 5888270 to Edwards (hereinafter simply "Edwards) and US 3281236 to Meissner (hereinafter simply "Meissner"):

The applicant respectfully traverses the rejection of the indicated claims in view of the combined Edwards and Meissner references.

The applicant traverses the Examiner's grounds of rejection of the indicated claims in view of the combined Edwards and Meissner references.

The Examiner's attention is first directed to the enclosed *Declaration* of Dr. Reuter, an acknowledged authority in the technical field to which the current invention relates. The enclosed *Declaration* is being entered as an Affidavit under 37 CFR 1.132, and its contents are herein incorporated by reference. The reasoning set forward in the enclosed *Declaration* provides grounds why the Examiner's rejection of the claims in view of the combined Edwards and Meissner references are improper.

With regard to the rejection of claims 1, 5-7, the Examiner's grounds of rejection are believed to be improper, as it appears that the Examiner's interpretation of the Edwards reference is that it dicloses an iron-based silicate slag. This is erroneous, as the only disclosure of Edwards is of a chemically distinct calcium ferrite slag. The Examiner's attention I directed to Paragraph 5(a) of the *Declaration* which lists all references to slag in Edwards, while paragraph 5(b) of the *Declaration* states that distinctly different slag systems (in terms of chemistry and characteristics) are used in Edwards and the invention of the presently rejected claims, particularly the invention defined in claim 1.

It is the applicant's position that Edwards does not teach positioning the lance tip so that the injected gas is unable to pass through the lower surface of the slag and the gas is substantially precluded from contacting the copper phase. It first is to be noted that claim 1 specifies a top-submerged lance having a discharge tip at its lower end. That is, the

lance is in an upright disposition as shown in Figure 3 of the present application and Figure 2 of Edwards; in which it dips down into the bath. The issue is how far the lance dips down into the bath. Claim 1 requires injection into the slag (and, hence, above the copper which is below the slag) by a positioning of the lance tip not disclosed by Edwards. As made clear by paragraph 6 of the *Declaration*, that positioning is to avoid the very condition Edwards stresses as being necessary. That is, Edwards requires the gas to contact the copper, whereas claim 1 requires that this contact be avoided. Meissner is ostensibly relied on to show that it is purportedly obvious to modify Edwards to avoid achieving the gas contact with the copper Edwards teaches to be necessary. Not only is this untenable based on Edwards, but also the reliance on Meissner for the purpose is untenable. Meissner does not disclose a lance having its lower end injecting into a slag phase and, indeed, the slag phase is simply a by-product of the process of Meissner and can be removed as it forms. Meissner does not disclose an adjustable lance, but only fixed tuyers (which, unlike a lance, do not project into or "lance" any atmosphere or material). More importantly, Meissner teaches the need for injected gas to contact the copper phase, which is in line with Edwards but contrary to claim 1, while Meissner does not inject into a necessarily present slag phase, again contrary to claim 1. These foregoing issues are discussed by paragraphs 7 and 8 of the *Declaration*.

With respect now to the Examiner's rejection of claims 3 and 4, the applicant traverses the Examiner's assertion that consideration of Edwards in view of Meissner would teach the process of claim 1. This is simply incorrect. The Examiner's attention is directed to paragraphs 5 to 9(a) of the *Declaration* for the rational why the Examiner's position is incorrect. Further, the combination of Edwards and Meissner does not teach a slag phase having a depth of from about 700 mm to about 1.7 m (as in claim 4). Similarly, the combination of Edwards and Meissner does not teach the slag phase depth of from about 500 mm to about 2 m . It then is asserted that it would be expected that the compositions taught by Edwards in view of Meissner would have a similar slag phase with a depth of from about 700 mm to about 1.7 m. Even if this assertion is correct, it is not relevant to the salient differences between claim 1 and Edwards, and also between claim 1 and

Edwards in view of Meissner, as reasoned in paragraphs 5 to 9(a) of the *Declaration*. If Edwards had used a slag depth as in claim 3 or claim 4, it would simply mean that the lance would have to extend through that slag depth to position the tip (at the lower end of the lance) close to or within the copper phase so that injected gas contacted the copper phase. In contrast, in the present invention, the lance would extend a lesser distance into the slag so that the gas was injected into the slag but did not contact the copper phase below the slag. In the case of Edwards, such a depth of slag is not of use in this regard, whereas it is of use in the invention of claim 1 in preventing the injected gas from reaching the copper phase. This issue is addressed more fully in by paragraph 9(b) of the *Declaration*.

With respect now to the Examiner's rejection of claims 13 and 14, the applicant traverses the rejection and directs the Examiner's attention to the remarks forming paragraph 10 of the *Declaration* which are responsive to the Examiner's rejection.

In view of the foregoing remarks, as well as in view of the remarks presented in the enclosed *Declaration*, reconsideration of and withdrawal of the outstanding grounds of rejection of the indicated claims are solicited.

Regarding the rejection of claims 8 – 12, under 35 USC 103(a) in view of US 5888270 to Edwards (hereinafter simply "Edwards) and US 3281236 to Meissner (hereinafter simply "Meissner"), further in view of WO 01/49890 to Poijarvi (hereinafter simply "Poijarvi"):

The applicant respectfully traverses the rejection of the indicated claims in view of the combined Edwards, Meissner and Poijarvi references.

The Examiner's attention is again directed to the enclosed *Declaration* of Dr. Reuter, an acknowledged authority in the technical field to which the current invention relates. The enclosed *Declaration* is being entered as an Affidavit under 37 CFR 1.132, and its

contents are herein incorporated by reference. The reasoning set forward in the enclosed *Declaration* provides further grounds why the Examiner's rejection of the claims in view of the combined Edwards, Meissner and Poijarvi references are improper.

The applicant traverses the Examiner's grounds of rejection of the indicated claims in view of the combined Edwards, Meissner and Poijarvi references.

With respect to the Examiner's rejection of claims 8-10, the applicant traverses the rejection and directs the Examiner's attention to the remarks forming paragraph 12 of the *Declaration* which are responsive to the Examiner's rejection.

With regard to the Examiner's rejection of claims 11 and 12, the applicant traverses the rejection and directs the Examiner's attention to the remarks presented in paragraphs 13 and 14 of the *Declaration* which are responsive to the Examiner's rejection

Accordingly, reconsideration of and withdrawal of the outstanding grounds of rejection of the indicated claims are solicited.

Should the Examiner in charge of this application believe that telephonic communication with the undersigned would meaningfully advance the prosecution of this application, they are invited to call the undersigned at their earliest convenience. The early issuance of a *Notice of Allowability* is solicited.

PETITION FOR A TWO-MONTH EXTENSION OF TIME

Applicants respectfully petition for a two-month extension of time in order to permit for the timely entry of this response. The Commissioner is hereby authorized to charge the fee to Deposit Account No. 14-1263 with respect to this petition. SMALL ENTITY status is claimed.

CONDITIONAL AUTHORIZATION FOR FEES

Should any further fee be required by the Commissioner in order to permit the timely entry of this paper, including any necessary extension of time petition and fee, the Commissioner is authorized to charge any such fee to Deposit Account No. 14-1263. SMALL ENTITY status is claimed.

Respectfully Submitted;

Andrew N Parfomak 06 July 2009

Andrew N. Parfomak, Esq. Date:
Reg.No. 32,431
Norris, McLaughlin & Marcus, PC
875 Third Avenue, 18th Floor
New York, NY 10022

Tel: 212 808-0700

Enclosure – *Request for Continued Examination*

Declaration of Dr. Reuter

CERTIFICATION OF TELEFAX TRANSMISSION:

I hereby certify that this paper is being telefax transmitted to the US Patent and Trademark Office to telefax number: 571 273-8300 on the date shown below:

July 6, 2009

Evangelina Exarhoulias Date:

C:\ANPCMB\102881\15\Amendment02.doc

PATENT

IN THE UNITED STATES PATENT AND TRADE MARK OFFICE

Applicant	Hughes et al	Examiner	Yoshitoshi TAKEUCHI
Series No.	10/599570	Group Art Unit	4162
Filed	January 31, 2007	Docket	102881-15/FF39694/06
Title	PROCESS FOR COPPER CONVERTING		

DECLARATION

1. I, Dr. A. Markus Reuter, of Apartment 6, 284 Williams Road, Toorak, Victoria 3142, Australia, am an internationally recognised expert in metallurgy and resource engineering. I have extensive academic and industry metallurgical experience, gained in several countries including South Africa, Germany, The Netherlands and Australia, primarily in non-ferrous metallurgy (including copper recovery), but also including ferrous metallurgy. I have a B.Eng Degree (Honours, Cum Laude) in Chemical/Material Process Engineering, an M.Eng Degree in Material Process Engineering and Ph.D. in Extractive Metallurgy, all from the University of Stellenbosch, South Africa. I have a Dr. habilitation from Aachen University of Technology, Germany and a D.Eng. (Doctorate in Engineering), also from the University of Stellenbosch. I was a Professor of Sustainable Technology, and now am a Professorial Fellow of Melbourne University, Australia, and I was Extraordinary Professor of University of Stellenbosch. I am Professor Emeritus, Delft University of Technology, the Netherlands.

2. I am a Registered Professional Engineer in South Africa and a Fellow of the Australian Institute of Engineers. I have presented numerous keynote and invited lectures and supervised many Ph.D. and M.Sc. Projects, while I have authored one technical book and contributed chapters to others. I have had over 350 papers published in refereed Journals and conference proceedings, and I have participated in many industrial consulting projects. I have extensive knowledge and experience in relation to the commercial processes for smelting sulphide ores and concentrates, and for the treatment of mattes. That includes knowledge and experience of top submerged lance smelting of copper sulphide ores and concentrates, and the treatment of copper matte for the recovery of blister

copper such as disclosed in US patents 5888270 (the Edwards patent) and US patent application 10/599570 (the present application). A copy of my full CV is attached.

3. I have been requested to provide this declaration by an Australian Patent Attorney acting for Ausmelt Limited, the assignee for US application 10/599570. I hold the position of Chief Executive Technologist at that company. For that purpose I have been provided with:

(a) a copy of US application 10/599570 (with the patent claims 1 to 3 and 14);

(b) a copy of a US patent Examiner's Office Action indicated as mailed on February 06, 2009 on application 10/599570; and

(c) a copy of prior patents comprising:

(i) US5888270 to Edwards et al. (the Edwards patent) assigned to Mount Isa Mines Ltd. and Commonwealth Scientific and Industrial Research Organisation;

(ii) US3281236 to Meissner, (the Meisner patent) assigned to Arthur D. Little Inc.; and

(iii) International Publication Number WO01/49890A1, by Polanyi et al (the Polanyi publication).

4. The reasoning of the objection to claims 1, 3 to 7, 13 and 14 in paragraph 4a of the Office Action is seriously in error in several important matters. These include:

(a) the reference to iron-based silicate slag;

(b) consideration of the failure of Edwards patent to disclose positioning of the lance tip as required by claim 1 of the present application; and

(c) the disclosure of the Meissner patent.

The reasons why these matters are seriously in error is explained in the following three paragraphs.

5. Slag Composition

5(a). The Edwards patent is completely free of any reference to an iron-based silicate slag. The Edwards patent makes clear that, in the process it discloses, slag type or composition is important. There are relevant references to slag composition type in the Edwards patent at

(i) column 2, lines 46 to 52;

(ii) column 3, lines 12 to 15;

(iii) column 4, line 21;

(iv) column 5, lines 36 and 39;

(v) column 7, lines 1 and 2, lines 30 and 31 and lines 48 and 49;

(vi) column 8, lines 5 and 6 and lines 56 and 57;

(vii) column 9, lines 14 and 15 and lines 48 and 49;

(viii) column 10, lines 11 and 12;

(ix) the second table at column 11;

(x) the table at column 12;

(xi) column 12, lines 16 and 17 and the following table;

(xii) column 13, lines 5 and 6 and the following table;

(xiii) column 14, lines 4 and 5 and the following table;

(xiv) column 15, lines 2 to 4 and the following table;

(xv) column 16, lines 1 to 3, the following table and lines 62 to 64; and

(xvi) column 17, lines 31 to 34 and the preceding table.

5(b). In each of these numerous references in the Edwards patent, the slag is either expressly identified as a calcium ferrite slag or a slag composition of a calcium ferrite slag is detailed (such as by the very high CaO/SiO_2 ratio at column 3, lines 12 to 16). Even the composition for a Mitsubishi process slag in comparative Example 4 at column 16 is a calcium ferrite slag, in line with established practice for the converting stage of the Mitsubishi process. Thus reference in paragraph 4a of the Office Action to the Edwards patent disclosing an iron based silicate slag is completely incorrect. It also results in an important difference between claim 1 of the present application and the Edwards patent being overlooked and not taken into account. That difference is in relation to slag required since, in contrast to the calcium ferrite slag of the Edwards patent, claim 1 of the present application necessitates an iron based silicate slag which differs in composition and characteristics from a calcium ferrite slag.

5(c). In both the Edwards patent and the process of claim 1 of the present application, matte is fed to and dispersed in the respective slag phase. In each case, the slag phase necessarily is present and it has a interface with a continuous copper phase. In contrast, in the process of the Meissner patent, a slag phase is not necessarily present in that it can be removed as it is produced. Moreover, the slag of the Meissner patent, while present, does not have an interface with a copper phase, as the slag and copper phases are separated by a layer of matte. Additionally, matte is not fed to the slag of the Meissner patent, rather, the

matte and the slag are produced by the process of the Meissner patent. It therefore is of no relevance that the slag of the Meissner patent is indicated as a silicate slag in which iron silicate is taken up.

6. Lance Tip Positioning

6(a). The sentence bridging pages 2 and 3 of the Office Action correctly states that the Edwards patent does not teach the lance tip positioning required by claim 1 of the present application. However, stating simply this is to fail to take into account the very important disclosure of the Edwards patent in relation to lance tip positioning necessary in the process of the Edwards patent. That failure then is exacerbated by a misunderstanding of the disclosure of and incorrect reliance on the Meissner patent, although these matters are dealt with in paragraph 7 herein. It is fundamental to the actual, express disclosure of the Edwards patent that the tip of the lance can not be as required by claim 1 of the present application. In the process of the Edwards patent there is a layer of a continuous blister copper phase and, on top of that layer, a layer of a continuous slag phase with an interface between those layers. In Figure 2 of the Edwards patent, the layer of slag phase (16) is shown on top of the layer of blister copper phase (15). The oxidizing gas is injected from the tip of a lance at a depth adjacent to the interface between the slag and blister copper for the reason, in the wording of claim 1 of the Edwards patent, "so as to ensure that a substantial portion of the gas contacts the continuous blister copper phase" (underlining added). As made clear throughout the Edwards patent, this contact between the oxidizing gas and the blister copper phase is a fundamental aspect of the process of that patent. Thus, in the process of the Edwards patent, the lance tip must be very close to or even below the top surface of the blister copper (that top surface, of course, being at the interface referred to in the first step of claim 1 of the Edwards patent and twice in the third step of that claim). Moreover, the Edwards patent is devoid of any indication to the contrary. Thus, it is insufficient merely to recognise that the Edwards patent does not teach positioning the lance tip as required by claim 1 of the present application. It also is necessary to recognise that the emphasis in the Edwards patent on lance tip positioning in fact precludes the positioning required by claim 1. That is, contrary to the Edwards patent, claim 1 of the present application requires positioning of the lance tip to substantially preclude the gas from contacting the copper phase. To ignore this is to ignore an express requirement of the process of the Edwards patent for a fundamental aspect of that process. That requirement is to achieve essentially what the process of claim 1 of the present application is to preclude.

7. The Meissner Patent

Despite the title, the Meissner patent is incorrectly stated in the paragraph commencing at page 3, line 3 of the Office Action to teach a method of copper refining. It is correctly recognised in the Office Action that the primary consideration in introducing the feed into the molten copper pool in the Meissner patent is that the depth of the introduction or blowing with respect to the surface of the molten pool be sufficient. However, these matters are incorrectly taken to be relevant to the process of claim 1 of the present application, as detailed in the following reasons:-

7(a) The "refining of copper" used in the title of the Meissner patent normally refers to processing a crude form of copper metal to a higher grade of copper metal. This is not what the Meissner patent relates to, as made clear by an understanding of columns 1 and 2 of that patent. More importantly the process of claim 1 of the present application does not relate to copper refining.

7(b) The Meissner patent, as indicated by all claims of that patent, relates to a method of producing copper from a copper sulphide ore, not from matte. This is in complete contrast to the claim 1 of the present application which relates to a process of converting copper sulphide matte to blister copper. That is, the process of claim 1 of the present application starts with matte (after it has been produced from copper sulphide ore) as distinct from starting with ore. The process of the Meissner patent in fact produces copper sulphide matte as a by-product (layer "4" in each of Figures 1 and 2). More importantly, and in contrast to claim 1 of the present application, the Meissner patent does not provide any disclosure on the treatment or conversion of matte.

7(c) The purpose of referring to the Meissner patent is to support the assertion in the Office Action that "it would have been obvious ... to optimise the Edwards process by adjusting the height of the lance so that the introduction of gasses is optimized for the process as described by Meissner". That assertion is incorrect and clearly contrary to both the Edwards patent and the Meissner patent since:

- as is evident from the above paragraph headed "Lance Tip Positioning", it is contrary to the Edwards patent to adjust the lance to a height which does not ensure that a substantial portion of the gas contacts the continuous copper phase, and nowhere in the Meissner patent is there any reference to "adjusting the height of the

lance' for any purpose, while Figures 1 and 2 of Meissner show only fixed tuyeres 11 and 17 respectively;

the Edwards patent requires the oxidizing gas to contact the copper phase, while the Meissner patent discloses only introducing ore and oxygen-containing gas beneath the surface of said molten copper by injecting directly into the metal by what comprise fixed tuyeres – see Figures 1 and 2; claim 1, lines 6 and 7; claim 5, lines 9 to 11 of step (a); and similarly, in step (a) of each of claims 10 and 15 of the Meissner patent – and as shown in each of Figures 1 and 2 of that patent;

column 6, line 72 to column 7, line 3 of the Meissner patent refers to "lance blowing of the feed downward into the molten copper" but, despite reference to a lance, the requirement of the blowing is to introduce oxygen-containing gas below the surface of the molten copper, and this is similar to the Edwards patent.

7(b). Thus, the Edwards patent and the Meissner patent are similar in requiring the oxygen to contact the molten copper phase. Each of these patents therefore excludes the requirement of claim 1 of the present application on the positioning of the lance tip to substantially preclude oxygen from contacting the continuous copper phase. That requirement is acknowledged in the Office Action as not being taught by the Edwards patent and it is not correct to suggest that the requirement is taught by the Meissner patent. As indicated above, the Office Action clearly is incorrect in asserting that "it would have been obvious ... to optimise the Edwards process by adjusting the height of the lance so that the introduction of gasses is optimised for the process, as described by Meissner".

8. The Meissner patent, in its reference to use of a lance, refers at column 6, third last line to "Lance blowing". At column 7, lines 1 and 2, there is reference to the depth of introduction or blowing. The clear indication here is that the lance tip is above the molten bath and is not submerged (as required by both the Edwards patent and the process of claim 1 of the present application). The new technology of top submerged injection, as distinct from top blowing, dates from US patent 4251271 to Floyd, referred to at column 3, line 2 of the Edwards patent. Insofar as the Meissner patent specifies blowing by use of a lance, the lance tip has to be close to the top surface of the molten copper in order for the oxygen-containing gas to be introduced below the surface of the molten copper, and this

necessitates a thin layer of slag and a thin layer of matte through each of which layers the blowing penetrates in order for the blowing to reach and penetrate into the molten copper. As with the Edwards patent, there is little scope for adjusting the height of the lance tip in the process of the Meissner patent, and adjustment to satisfy claim 1 of the present application is contrary to the express requirements of both the Edwards patent and the Meissner patent. Also, as indicated, Meissner discloses use of a layer of matte between the slag layer and the molten copper which is contrary to the express requirements of claim 1 of the present application for (a) matte dispersed in a slag phase and, hence, (b) a slag/copper interface.

9(a). In the objection in paragraph 4b of the Office Action, it is asserted that "Edwards in view of Meissner teaches the process of claim 1". I understand this to mean that, as asserted in paragraph 4a, claim 1 is obvious in view of optimising the process of the Edwards patent as described by the Meissner patent. For reasons detailed above with reference to the Edwards and Meissner patents, that assertion of paragraph 4b is incorrect and inconsistent with both the Edwards patent and the Meissner patent. On the basis of the incorrect assertion, it is recognised that the combination of the Edwards and Meissner patents does not explicitly teach a slag phase depth of from about 700mm to about 1.7m. It then is suggested that because the processes and treated compositions are similar, in the absence of proof to the contrary, it would be expected that Edwards in view of Meissner would have a similar slag phase depth of from about 700mm to 1.7m as claimed. It is quite clear that the processes and treated compositions are not similar. Also, the reason for such slag depth in claims 3 and 4 of the present application provides proof that the process of the Meissner patent would not have a slag depth of from 700mm to 1.7m as explained in the following:

> In relation to the processes, the Edwards patent discloses a two phase bath comprising a slag phase floating on a continuous copper phase so that there is a slag/copper interface, whereas the Meissner patent discloses a three phase molten pool (bath) with a matte phase between the slag and copper phases and no slag/copper interface.
>
> In relation to the treated compositions, the process of the Edwards patent adds ore and/or matte to the slag phase and disperses them in the slag phase, whereas in the process of the Meissner patent the ore and flux are added to the molten copper.

also by reactions in the copper phase the process of the Edwards patent produces copper phase at the slag/copper interface by reactions involving the ore and/or matte in the slag phase which produce copper from matte added or produced, whereas in the process of the Meissner patent the added ore is reacted in the copper phase to produce copper and also to produce matte which increases the matte phase, while the process of the Meissner patent also produces slag but does not require the presence of the slag for operation of the process.

9(b). On the objection at paragraph 4(b) to claims 3 and 4, it is to be understood that claim 1 of the present application requires the lance tip to be positioned so that the gas injected into the slag by the lance does not pass through the lower surface of the slag (which is at the interface between the slag and the copper phase) and the gas is precluded from contacting the copper phase. Claims 3 and 4 give examples of slag depths which enable the constraint on injection into the slag without contacting the copper. If the process of the Meissner patent uses a lance, rather than an arrangement as in Figures 1 and 2, it is to be noted that the lance is used for top blowing, i.e. blowing from above the top surface of the slag. If the depth of slag as in claim 3 or 4 is sufficient to enable the lance tip to be positioned to prevent gas injected into the slag from contacting the copper phase, then such a depth of slag with top blowing as in the Meissner patent will even more readily prevent the top blown gas from contacting the copper phase, contrary to express requirement of the Meissner patent for introducing the ore and oxygen beneath the surface of the molten copper to facilitate the reactions explained in the Meissner patent. That is, in relation to whether or not oxidizing gas is to contact the copper phase, the express necessary requirement of the Meissner patent and also the Edwards patent on the one hand and the express necessary requirement of claims 1, 3 and 4 of the present application on the other hand are mutually exclusive. Also, a depth of slag as in claim 3 or 4 in the process of the Edwards patent does not detract from the requirement of the Edwards patent for the gas to contact the copper phase whereas in claims 1, 3 and 4, the gas is not to contact the copper phase, so that injection would need to be close to the bottom, or beyond the bottom, of that depth of slag.

10. The said in the Office Action in paragraph 4c that it would be obvious that lump coal could be used as a reductant. It is not indicated whether it is obvious that lump coal could be used in the process of the Edwards patent or the Meissner patent. The Edwards patent at column 3, lines 40 to 46 in fact discloses the addition of lump coal, although the suggestion is

incorrect in respect of the Meissner patent. As indicated at page 13, lines 8 to 16 of the present application, the lump coal is used because it floats, with the benefit of adding coal being to prevent formation of magnetite in the slag, and thereby avoid foaming of the slag. Thus, in the process of claim 1 of the present application, lump coal is not the just a reductant in the classical sense; rather it is used for process control, for mitigation of foaming. However, foaming is a risk with the iron based silicate slag required for the present invention, not with the calcium ferrite slags required in the process of the Edwards patent. Also, the benefit in adding lump coal to the calcium ferrite slag of the process of the Edwards patent is simply to provide further reductant, a quite different purpose. However, this would not correct any of the deficiencies I have highlighted above in relation to paragraphs 4a and 4b of the Office Action.

11. In paragraph 5a of the Office Action, it again is incorrectly asserted that the Edwards patent in view of the Meissner patent teaches the process of claim 1, but does not teach an iron based silicate slag. The combination of those patents does not teach the process of claim 1 for the numerous reasons I have detailed above. Also, in consideration of the combination of those patents, paragraph 5a acknowledges that the combination does not disclose the requirement of claim 1 of the present application for iron based silicate slag, whereas the objections of paragraphs 4a, 4b and 4c fail to take this deficiency into account. As I pointed out above under the heading "Slag Composition", the Edwards patent discloses a calcium ferrite slag, not an iron-based silicate slag. The Meissner patent refers broadly to the iron silicate slag system in practice in the 1960's, in line with typical Peirce-Smith converter slag practice at that time.

12. It is asserted in paragraph 5a of the Office Action that the Poljarvi publication discloses the use of a fayalite (iron-based silicate) slag and that it would be obvious to use that slag of the Poljarvi publication in the process of the Edwards patent as modified in accordance with the Meissner patent. However claims 8 to 10 of the present application, to which this assertion is directed, have the requirements of claim 1. Nothing in the Poljarvi publication makes good the clear deficiency of the combination of the Edwards and Meissner patents relative to claim 1 (and hence all claims) of the present application. Moreover, the context of the Poljarvi publication is completely different to that of the Edwards patent. As a consequence, the Poljarvi publication does not indicate a slag is "used" in a manner related to that of the Edwards patent. In the process of the Edwards patent, there is a pre-existing slag phase to which the ore or matte is added and dispersed. Also, injection of oxygen into a pre-existing copper phase results in reactions in the copper phase and at the interface between the slag and copper phase, which result in the production of blister copper. In the

suspension reactor of the Poljarvi publication (furnace FSF in each of Figures 1 and 2 of that patent), ore, granular matte, flux and oxygen are charged through a burner at the top of the FSF furnace – Figure 2 shows matte charged through the side but, as indicated in the sentence bridging pages 5 and 6, it is charged at the top with the other feed. In contrast to the invention of the present application, as well as the processes of the Edwards and Meisener patents, the FSF furnace of the Poljarvi publication is not a bath type of operation. Rather, as the ore, flux and matte particles fall in the FSF furnace, they react in the solid state, they melt due to the heat of reaction, decompose and react to produce blister copper and slag which are collected and separated. It will be noted that the output from the FSF reactor of each of Figures 1 and 2 of the Poljarvi publication is shown solely as blister and slag. In contrast to the Edwards patent, slag is not used to disperse ore or matte for reaction with a molten copper phase. It is considered that the Poljarvi publication provides no guidance in relation to a slag to be used in the process of the Edwards patent. It was well known at the time of the Edwards patent that iron-based silicate slags were used or produced in the different contexts of other copper producing processes, and yet the Edwards patent refers throughout only to calcium ferrite slags for the process of that patent.

13. Paragraph 5b of the Office Action makes an assertion which is technically unsound. It is based on the ratio of CaO:Fe in the Edwards patent and $Fe:SiO_2$ in the Poljarvi publication and contends that it would be obvious to use fayalite with the Fe to SiO_2 ratio of the Poljarvi publication in the process of the Edwards patent. This suggested "since fayalite is useful as a source of iron and silicate in the slag". This reasoning fails to explain what benefit there would be in the process of the Edwards patent in having a source of iron and silica relative to the content in the chosen calcium ferrite slag for that process. Also, relative to the three ratios specified in claim 11, there is no logical basis for linking the CaO:Fe ratio of the calcium ferrite slag of the Edwards patent and the $Fe:SiO_2$ of fayalite slag of the Poljarvi publication. A person skilled in the art would recognise that the ratios of CaO/Fe, Fe/SiO_2 and Fe/SiO_2 describe boundaries to a specific area of a complex ternary phase diagram. The skilled person would further recognise that adding a respective ratio from each of two independent sources (such as in the case of the Edwards patent and the Poljarvi publication) is technically unsound unless each source is concerned with the same actual slag system (which is not so in that case). Clearly the Poljarvi publication does not provide a basis for asserting that it would have been obvious "to use the fayalite with a Fe/SiO_2 ratio of 1.367 in the process of Edwards", since the calcium ferrite slag which the Edwards patent requires is distinct from the fayalite slag of the Poljarvi publication. It also is worth noting that the figures given for the fayalite slag of the Poljarvi publication (28.7% Fe and 21% SiO_2) indicate a CaO content of about 50.3%, such that the CaO/SiO_2 ratio is about 2.40 and well

outside the range of 0.22 to 1.11 specified in claim 11 of the present application. In any event, this does not in any way make good the clear deficiencies considered above on the combination of the Edwards and Meissner patents, with or without the Poljarvi publication, in relation to the process of claim 1 of the present application.

14. Paragraph 5c of the Office Action is correct in its opening sentence. However, the fact remains that the Edwards patent discloses a calcium ferrite slag and even outside the range of $CaO:SiO_2$ of 5 to 10, the requirement still is for a calcium silicate slag. This is quite distinct from an iron-based silicate slag, particularly with the range of claim 11 of the present application of 0.22 to 1.11. The issue is not one of simply moving along a continuous scale of optimum or workable ranges, but of recognising that the process of the present invention uses a slag of a recognised type which is different from the recognised slag type for the process of the Edwards patent. Moreover, the Office Action asserts it is well known that SiO_2 in the sand reacts with CaO to form $CaSiO_3$. However, I note that the Edwards patent makes reference to the presence of SiO_2 from various sources, but specifies a calcium ferrite slag which is not based on $CaSiO_3$ but on $CaFe_2O_4$ and necessitates a low SiO_2 content such as below about 1%. However, there again remains the clear deficiencies of the Edwards patent, whether in combination with one or both of the Meissner patent and Poljarvi publication, in respect of the process of claim 1 (and, hence, each of the claims) of the present application.

I further declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements are made with the knowledge that wilful false statements and the like are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such wilful false statements may jeopardise the validity of this application or any patent issuing thereof.

(Markus A. Reuter)

2/7/2009
Dated